

REMARKS/ARGUMENTS

Claims 1-7, 9, 13-15, 23-29, 33-35, 39-41 and 82-83 are pending in this application. Claims 1 and 9 have been amended. Claims 10, 11, 16-18 and 87 have been canceled. Applicants acknowledge with appreciation the allowance of claims 88-93.

Claims 1 and 22 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Sapozhniko et al. (SU 593110A) (“Sapozhniko”). The rejection is respectfully traversed.

The claimed invention is a non-aqueous etching mixture which consists essentially of an alcohol in combination with at least two inorganic acids. As such, amended independent claim 1 recites an etching composition consisting essentially of “a non-aqueous composition of an alcohol and at least two inorganic acids, wherein one of said inorganic acids is selected from the group consisting of phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid.” Independent claim 22 also recites an etching composition consisting essentially of “a non-aqueous composition of an alcohol and at least two different inorganic acids selected from the group consisting of hydrofluoric acid, phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid.”

Sapozhniko does not disclose the limitations of claims 1 and 22. Sapozhniko discloses an etching solution of glycerin, nitric acid and hydrofluoric for increasing the sensitivity of measurements for hammer-hardened surface layers. (Abstract). According to Sapozhniko, “the polished surface of [a] tested sample, before deformation, is etched in a glycerin soln. of nitric and hydrofluoric acids ($\text{HNO}_3 + \text{HF} = 5:10\%$).” (Abstract). Sapozhniko does not disclose, however, a “a non-aqueous composition of an alcohol and at least two inorganic acids, wherein one of said inorganic acids is selected from the group

consisting of phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid," as amended independent claim 1 recites. Sapozhniko discloses only nitric and hydrofluoric acids, but these acids are not recited as limitations of amended independent claim 1.

Further, Sapozhniko does not disclose "a non-aqueous composition of an alcohol and at least two different inorganic acids selected from the group consisting of hydrofluoric acid, phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid," as independent claim 22 recites. Applicants note that, according to claim 22, the "two different inorganic acids" must be selected from the above-recited group, which does not include nitric acid. Thus, the limitations of independent claim 22 are not described in Sapozhniko and the subject matter of claims 1 and 22 is not anticipated under 35 U.S.C. § 102.

Claims 2-7, 9, 13-15, and 33-35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sapozhniko et al. (SU 593110A) ("Sapozhniko") as applied to claims 1 and 22. The rejection is respectfully traversed.

As noted above, the claimed invention teaches an etching mixture which consists essentially of a non-aqueous composition of an alcohol in combination with two inorganic acids. As such, dependent claim 2 recites that the alcohol is "a polyhydric alcohol," while dependent claim 3 recites "ethylene glycol, propylene glycol, butylene glycol, dipropylene glycol, sorbitol, hexylene glycol, 1,3-dibutylene glycol, 1,2,6-hexanetriol and 1,5-pentanediol" as choices for the polyhydric alcohol. Dependent claim 5 further recites that the alcohol is propylene glycol, while dependent claims 13 and 33 recite that the ratio of alcohol to a first acid to a second acid is of about 10-50:5-40:1, while dependent claims 15 and 35 further limit such ratio to about 30:20:1.

The subject matter of claims 2-7, 9, 13-15, and 33-35 would not have been obvious over Sapozhniko. First, Sapozhniko is silent about an etching solution consisting essentially of “a non-aqueous composition of an alcohol and at least two inorganic acids, wherein one of said inorganic acids is selected from the group consisting of phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid,” as independent amended claim 1 recites, or about “a non-aqueous composition of an alcohol and at least two different inorganic acids selected from the group consisting of hydrofluoric acid, phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid,” as independent claim 22 recites. Sapozhniko is also silent about any ratio of a first acid to a second acid, much less about any ratio of a first acid to a second acid to an alcohol.

Second, the crux of Sapozhniko is a liquid mixture consisting only of HF, HNO₃, and glycerin used in a “thickness measuring technique of surface hammer hardened layers” for improving the sensitivity of the polished surface of a tested sample before deformation. (Abstract). Sapozhniko does not teach or suggest an etching composition consisting essentially of “a non-aqueous composition of an alcohol and at least two inorganic acids, wherein one of said inorganic acids is selected from the group consisting of phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid” (claim 1) or of “a non-aqueous composition of an alcohol and at least two different inorganic acids selected from the group consisting of hydrofluoric acid, phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid” (claim 22). Accordingly, the subject matter of claims 2-7, 9, 13-15, and 33-35 would not have been obvious over Sapozhniko and the rejection of these claims is respectfully requested.

Claims 39-41 and 83 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Holoubek J. (CS 8801729A) (“Holoubek”). The rejection is respectfully traversed.

As noted above, the claimed invention recites a non-aqueous etching composition which consists essentially of an alcohol in combination with at least two inorganic acids. As such, independent claim 39 recites "a non-aqueous composition comprising propylene glycol, nitric acid and hydrofluoric acid" in a ratio of 10-50:5-40:1 for selectively etching doped polysilicon to undoped polysilicon. The ratio of propylene glycol to nitric acid to hydrofluoric acid is further defined in claims 40 and 41 as of about 20-40:10-30:1 and 30:20:1, respectively. Independent claim 83 further recites an etching composition consisting essentially of "a non-aqueous composition of propylene glycol and at least two inorganic acids, wherein one of said inorganic acids is selected from the group consisting of hydrofluoric acid, phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid."

The subject matter of claims 39-41 and 83 would not have been obvious over Holoubek. First, Holoubek discloses a mixture of nitric acid and hydrofluoric acid, diluted by ethylene glycol as a "[B]ath for etching chromium silicide layer." (Title; Abstract). Holoubek is silent, however, as to the presence of propylene glycol in non-aqueous etching compositions. Holoubek is further silent about "a non-aqueous composition comprising propylene glycol, nitric acid and hydrofluoric acid" (claim 39), or about "a non-aqueous composition of propylene glycol and at least two inorganic acids" (claim 83). Second, Holoubek is silent about any ratio of hydrogen fluoride to nitric acid, or any ratio of propylene glycol to nitric acid to hydrofluoric acid. Third, Holoubek is silent about using propylene glycol, or using propylene glycol at 35°C, on doped and undoped polysilicon. The crux of Holoubek is a bath etch for etching a particular layer of an integrated circuit, that is a chromium silicide layer, and not for etching doped to undoped polysilicon. Fourth, Holoubek teaches a weak, diluted solution of ethylene glycol and nitric and hydrofluoric acids as a bath etch for chromium silicides. In contrast, the non-aqueous composition comprising propylene glycol of the claimed invention are not weak, but rather have a high concentration of a first acid relative to propylene glycol, that is a ratio of

5-40:10-50 (claim 39) or 10-30:20-40 (claim 40) or 20:30 (claim 41). Accordingly, the subject matter of claims 39-41 and 83 is not obvious over Holoubek, and withdrawal of the rejection of above-mentioned claims is respectfully requested.

A marked-up version of the changes made to the specification and claims by the current amendment is attached. The attached page is captioned "Version with markings to show changes made."

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

Dated: October 18, 2001

Respectfully submitted,

By 

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Version With Markings to Show Changes Made

1. (four times amended) An etching composition consisting essentially of:
a non-aqueous composition of an alcohol and at least two inorganic acids,
wherein one of said inorganic acids is selected from the group consisting of [hydrofluoric acid,] phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid.

9. (amended) The composition according to claim 1, wherein said inorganic acids are selected from the group consisting of [hydrofluoric acid,] nitric acid, phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid.